

# Revising Program-Level Learning Outcomes: Methodology, Results and Lessons Learned

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# Abstract

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- ❖ We developed a methodology for revising Program-level Learning Outcomes (PLOs) that is efficient, effective and readily adaptable for other degrees.
- ❖ In this session, we will:
  - introduce our methodology
  - present preliminary findings on how the program-level learning outcomes (PLOs) should be revised
  - identify what worked well versus how the methodology could be improved upon in the future
  - offer insights into how the methodology could be used to revise learning outcomes in other disciplines.

# Introduction to the Project

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- ❖ In Fall semester 2016, all faculty members teaching courses in the B.S. in Informatics program were asked by the Associate Dean for Academic Affairs at the School of Informatics and Computing to add Program-Level Learning Outcomes (PLOs) to their syllabi and to tie these PLOs to specific assignments and other assessment methods in their courses.
- ❖ This information was intended to complement the current syllabus requirement to match learning outcomes and assignments with the PULs.
- ❖ It is likely that most faculty members did not do this because of the short timeframe and lack of understanding about the PLOs.

# Introduction to the Project

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- ❖ Unfortunately, the current PLOs for the B.S. in Informatics are generic, woefully outdated, difficult to measure and have not kept up with the evolution of the fast-changing discipline of Informatics and the emerging career opportunities for people with this degree.
- ❖ Moreover, several of the items within the PLOs actually refer to what students will do once they complete their degrees, which the school has no control over and no way to track after graduation.
- ❖ One of the project directors (Sara) did add information about the PLOs to her syllabi and linked them to individual assignments, but found it frustrating because of issues with the existing PLOs.

# Examples of Current PLOs for the B.S. in Informatics Degree

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- ❖ Understand and apply major societal trends affecting the development and deployment of modern day IT, such as access, privacy, intellectual property, security and others.
- ❖ Commit to a regular program of continuing education and lifelong learning that is independent of employer sponsorship.
- ❖ Participate in professional organizations that promote responsible computing and service to society.
- ❖ Select and effectively utilize oral, written, visual and quantitative communication skills within the context of an interdisciplinary team.
- ❖ Acquire fundamental concepts and skills in software architectures and the development of information systems

# Existing PLOs Are Organized Under the Following Headings

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- ❖ Technical Knowledge
- ❖ Social Dynamics of Informatics and Information Technology
- ❖ Domain-specific\* Critical Thinking and Problem Solving Skills
- ❖ \*Domains are areas of specialization that may include business, science, the arts or humanities.
- ❖ Collaborative Teamwork
- ❖ Professional Ethics and Development

# First Steps in the Project

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- ❖ We conducted a literature review to see what methodologies had been used to develop program-level learning outcomes for similar disciplines.
- ❖ Through the literature review, we also were able to find program-level learning outcomes that had been developed by similar disciplines, such as IS (Information Systems) and MIS (Management Information Systems).
- ❖ However, none of these program-level learning outcomes fit our needs, especially since the B.S. in Informatics is a unique degree in an emerging discipline.
- ❖ Moreover, we wanted to look at what the future trends would be in revising our PLOs, rather than focusing on the current status of the field.
- ❖ We applied for and were awarded a PRAC grant for our project in December 2016.

# Syllabus Review

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- ❖ Reviewed core required courses and some selected, regularly-offered elective course for the time period Fall 2016-Spring 2017.
- ❖ Total of 18 courses were included.
- ❖ Majority of syllabi did not include the Program-level Learning Outcomes (PLOs).
- ❖ Even fewer syllabi had the PLOs actually tied to assignments in the courses.
- ❖ Here is the table with the detailed results.
- ❖ The suggested format for syllabi, including PULs, PLOs, Revised Bloom's Taxonomy (RBT) and course assessments (homework, exams, etc. .
- ❖ How one of the project directors (Sara) arranged her syllabi.



Course	Syllabus Year, Semester	PLOs Included	PLOs Tied to Assignments
INFO I100	2016, Fall	Y	N
INFO I201	2017, Spring	N	N
INFO I202	2017, Spring	N	N
INFO I210	2016, Fall	N	N
INFO I211	2017, Spring	N	N
INFO I223	2016, Fall	Y	Y
INFO I350	2016, Fall	N	N
INFO I402	2017, Spring	N	N
INFO I453	2017, Spring	N	N
INFO I270	2017, Spring	N	N
INFO I275	2016, Fall	N	N
INFO I303	2016, Fall	N	N
INFO I305	2016, Fall	N	N
INFO I308	2017, Spring	N	N
INFO I330	2017, Spring	Y with link to online document	Y
INFO I421	2016, Fall	N	N
INFO I425	Has not been offered yet		
NEWM N220	2017, Spring	N	N
NEWM N299	2017, Spring	N	N
<b>Total</b>	19	Yes: 3 No: 15 N/A: 1	Yes: 2 No: 16 N/A: 1

Upon completion of this course, students will	RBT	PUL	SWC	PLO	Assessment
1. describe the nature of the data, how it is structured, stored, and accessed, including relational models and tables	2	3	3.1	1	Homework 1 Quiz 1 Midterm 1 Final Exam
1. munge data to prepare raw data for further analysis	3	2	3.3	1	Homework 1 Midterm 1
1. analyze large, complex datasets with supervised learning methods, including linear regression and k-nearest neighbors for functional approximation and naïve Bayes and decision trees for classification and predictive modeling	4	1B	3.4–3.8	1	Homework 3, 4 Midterm 1, 2 Quiz 2 Final Exam
1. analyze large, complex datasets with unsupervised learning methods, including k-means clustering	4	1B	3.4–3.8	1	Quiz 2 Homework 6 Final Exam
1. calculate probabilities by applying additive and multiplicative laws, permutations and combinations, and conditional probability	3	1B	3.3	1	Homework 2 Midterm 1 Final Exam
1. calculate expectation and variance from the probability distribution of a random variable	3	1B	3.3	1	Homework 2 Midterm 1 Final Exam
1. assess model fit (e.g., overfitting or underfitting)	5	1B	3.6, 3.7	1	Homework 5 Midterm 2 Final Exam
1. create visualizations of data to communicate and persuade	6	2	3.2, 3.8	1, 4	Homework 2 Midterm 1 Project
1. derive information from data and support conclusions or recommendations based on evidence existing in the data	5	2	3.4, 3.6, 3.8	1, 4	Project Final Exam

## Learning Outcomes

Upon completion of the course, students will be able to:

- Express the global and local nature, including the risks and threats, of information security and privacy. [PULs 2 and 3][RBT 4][PLO 2 and 3][DF, E, CS, SR]
- Assess the information security and privacy lifecycle. [PULs 2 and 3][RBT 5][PLO 3][DF, E]
- Evaluate the impact of the Internet on information security and privacy, including access, jurisdiction, speech and intellectual property. [PULs 2 and 3][RBT 5][PLO 2 and 3][DF, E, CS, SR]
- Interpret state, national and international laws, regulations and other obligations for information security and privacy. [PULs 2 and 3][RBT 5][PLO 3][DF, E, AR, CS]
- Reframe the issues of information security and privacy based on unlawful versus lawful data disclosure. [PULs 2 and 3][RBT 5][PLO 3][DF, E, CS]
- Interpret the duty of confidentiality as it relates to medical, financial and personal information under federal and state laws and outline what to do if there is a breach. [PULs 2, 3 and 6][RBT 5][PLO 2, 3 and 5][DF, E, CS, SR]
- Analyze a variety of case decisions related to information security and privacy. [PULs 2 and 3][RBT 4][PLO 3][DF, E, CS]
- Articulate the special legal and ethical obligations of attorneys and the legal team for information security and privacy. [PULs 2, 3 and 6][RBT 3][PLO 3 and 5][DF, E, AR, CS, SR]
- Classify the criminal and civil liability that organizations may face for improper security and privacy measures and what the penalties might be. [PULs 2 and 3][RBT 4][PLO 3][DF, E, CS]

# Faculty Survey

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- ❖ We confined the recipients of the faculty survey to only faculty members who have regularly taught core required or selected electives in the B.S. in Informatics degree.
- ❖ This included several adjunct faculty members who had taught a course for more than only one semester.
- ❖ We were only interested in feedback from faculty members who were familiar with the B.S. in Informatics degree, rather than all faculty members in the School of Informatics and Computing.
- ❖ This limited our pool of survey recipients to only 14 faculty members and we only received 4 responses.
- ❖ This was primarily due to the fact that two or three faculty members teach a significant number of core required courses.
- ❖ We used Google Forms to distribute the survey and the survey results were anonymous.

# Faculty Survey Questions

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- ❖ What kinds of skills and knowledge are you looking for in thinking about how to prepare students as part of their B.S. in Informatics degree?
- ❖ What are the short- and long-term trends that you are seeing in IT, especially as they relate to Informatics?
- ❖ What specific technology skills should a graduate of the B.S. in Informatics program have?
- ❖ What “soft skills” should a graduate of the B.S. in Informatics program have?
- ❖ What kinds of skills, knowledge and experiences have helped students be successful in finding a position in the field of Informatics?
- ❖ Of the current PLOs, which should be retained and how can they be assessed or measured?
- ❖ Any other information or insights that you would like to share?

# Faculty Survey Responses

Question #1: Skills & knowledge to prepare students	Question #2: Short- & long-term trend in IT fields	Question #3: Technology skills a graduate should have	Question #4: Soft skills a graduate should have	Question #5: Skills and experience that have helped a graduate in finding a position	Question #6: Current PLOs to be retained
Programming Algorithmic thinking UX design Data integration & analytics Data transformation Data visualization Tools and practices used in industry Ethical and proper use of technology	Big data Machine learning Augmented reality Mobile apps Data integration and governance Data parsing Cloud data warehousing	Scripting and programming Relational and non-relational database fundamentals UX design Data analysis Hands-on Bi, ETL and analytic tools Data integration and mining tools	Communication Teamwork strategies Design ethics Organization skill Ability to teach and train others Project management	Technology knowledge Web Data structures Data indexing, mining, and visualization Critical thinking	Measurable project-based learning activities Cases studies may be helpful in assessment.

# Interviews

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- ❖ With Department Chair, two Career Services professionals from our school and two representatives from companies who have hired graduates of our B.S. in Informatics program.
- ❖ We used the same questions from the faculty survey with our interviewees, modified slightly to fit their roles.
- ❖ Interviews were conducted in person or by telephone.
- ❖ Responses were very similar to those we received through the faculty survey, with more emphasis on soft skills and less on technical skills.
- ❖ Data indicate that 92% of our recent graduates are either working full time, attending graduate school or have started their own companies.
- ❖ Some students do not take advantage of experiential opportunities to address deficiencies in their soft skills.

# Interview Responses

Question #1: Skills & knowledge to prepare students	Question #2: Short- & long-term trend in IT fields	Question #3: Technology skills a graduate should have	Question #4: Soft skills a graduate should have	Question #5: Skills and experience that have helped a graduate in finding a position	Question #6: Current PLOs to be retained
Project management Business aspects of technical knowledge Some SQL Internships Service learning projects Case studies/real-life scenarios Presentation skills I210/I211 courses Adapt technology to different settings Privacy Cybersecurity B2B IT C2B IT Different types of IT (voice)	Strong customer service Work as a team Relationship building Will mold them on the technology side internally SaaS Machine learning AI Data analytics/Big Data Ability to see the “big picture” and entire scope of a project Coding and programming Diversity – gender and ethnicity Non-traditional user interfaces Intelligent interfaces	Proprietary systems Agile methodology Project management tools Microsoft Office suite Different platforms CSS, Java, Python Angular Web analytics Education v. training – the complexity of the problem	Project management Interpersonal communication Relationship building Problem-solving Working in a team Global teams Communication skills in all formats (web, video, audio, oral, written) Communicate in non-technical fashion Networking skills Able to accept constructive feedback Student groups Capstone projects	Relationship building Work with customers in difficult situations Ready to learn Internships Shadowing in a technology company Volunteering/community involvement Opportunities through SoIC’s Career Services Office More Q&A in employer sessions	Analyze impact of IT Collaborative Teamwork Technical Knowledge Social Dynamics and IT Domain-Specific Critical Thinking and Problem Solving Skills Collaborative Teamwork Professional ethics



# What Worked Well with Our Methodology

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- ❖ Syllabus review process was fairly straightforward because all of our syllabi are posted on the program's website and faculty members are expected to follow a standard syllabi format.
- ❖ Faculty members are expected to update and then upload the most recent version of their syllabi to the program's website. Thus, we were working with the most current version of syllabi for the courses we examined.
- ❖ The combination of syllabi review, targeted faculty survey and interviews with key stakeholders (department chair, Career Services professionals and industry representatives) covers the full spectrum of people who should be informing our B.S. in Informatics curriculum.

# How the Methodology Could Be Improved Upon in the Future

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- ❖ Collect more responses from the survey – which would be less of a problem in larger, more established department that would have more faculty members who would be eligible to participate.
- ❖ Interview more industry representatives from a wider spectrum of potential and recent employers of the graduates of our program.
- ❖ Since one finding from the project was that the industry representatives (and our Career Services Professionals) were much more focused on the “soft skills” rather than technical skills, perhaps more time and more interview questions could be devoted to exploring that aspect of the curriculum and how to assess whether students have gained these soft skills.

# Preliminary Results

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- ❖ Our methodology can easily be used by other disciplines.
- ❖ We have enough information to be able to revise the current PLOs.
- ❖ Some of the current PLOs are still valid, but merely need to be restated so that they can be assessed.
- ❖ The next step is to finalize our preliminary recommendations and circulate them to our faculty members, our department chair and school administration.
- ❖ Once the PLOs are approved, we will then work with faculty members to add them to syllabi and provide recommendations for how to assess them in individual courses.
- ❖ The B.S. in Informatics program is currently going through the PRAC process and our project can be reflected in the report.

# Questions and Discussion



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THANK YOU FOR ATTENDING OUR PRESENTATION! SARA AND LOUIE